

**FOR**

*lightweight insulating* **CONCRETE**

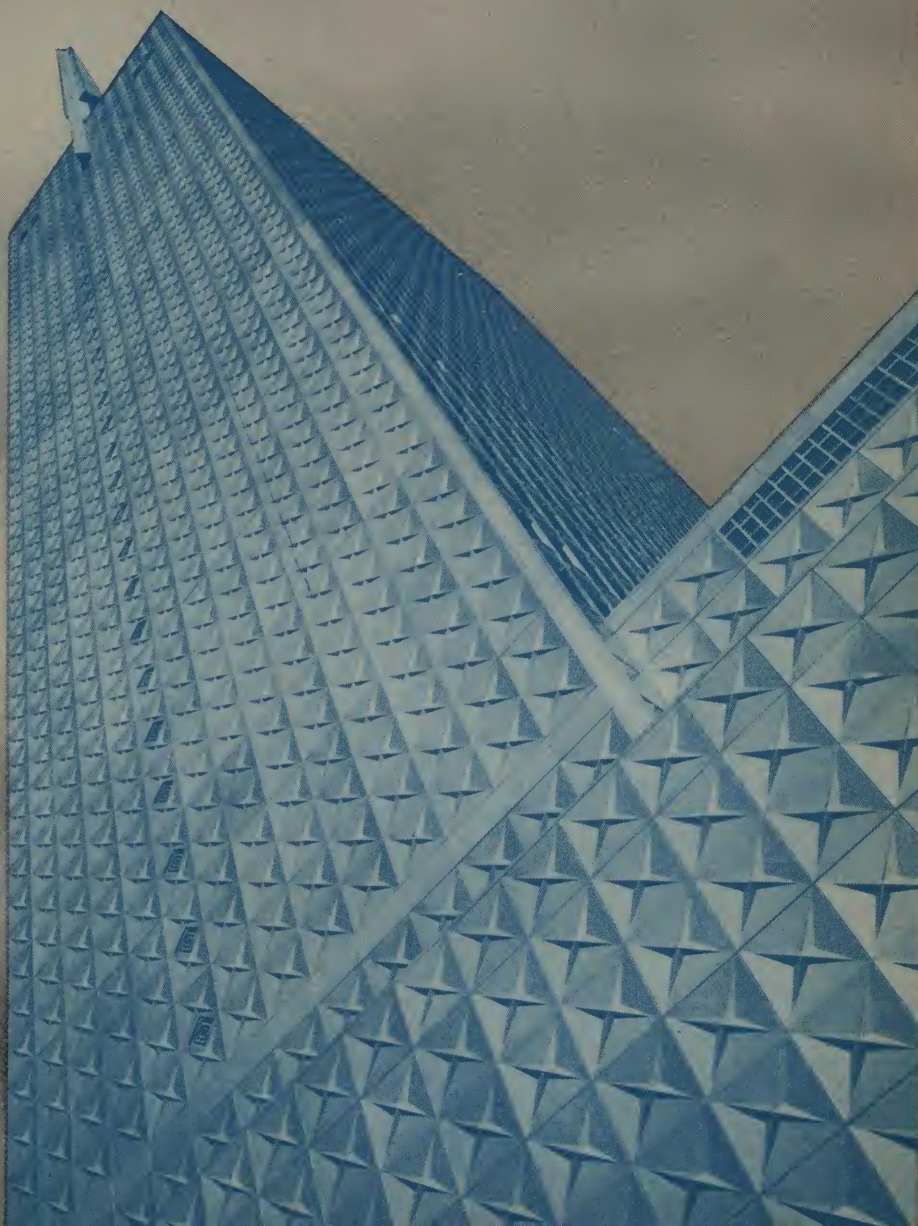
**ROOF DECKS, ROOF FILL,**

**FLOOR SLABS, FLOOR FILL,**

**AND CURTAIN WALLS**

**Permalite<sup>®</sup>** *concrete aggregate*

*the leading perlite aggregate for better plaster and concrete*







### *lightweight*

**PERMALITE** is less than  $\frac{1}{10}$ th the weight of sand. PERMALITE concrete is the lightest of all mineral concrete — so light that it actually floats on water! While ordinary sand-gravel concrete weighs 120 to 150 lbs. per cu. ft., PERMALITE concrete can be mixed to weigh from 20 to 50 lbs. per cu. ft. Used for lightweight insulating concrete roof decks, roof fill, floor slabs, and floor fill, it makes possible immense savings in dead-weight.

## Permalite®

is the registered trade-mark of the leading perlite aggregate for better plaster and concrete. Perlite, the raw material from which PERMALITE is processed, is a non-metallic mineral, a siliceous volcanic rock. When crushed to size and heated quickly to a suitable point in its softening range (above 1500° F), the select perlite ore expands to form high-quality perlite aggregate, a lightweight, non-combustible, glass-like material of cellular structure. Because of its extremely light weight and relatively great strength, as well as its insulating, fire-resistant, and other unique qualities, PERMALITE concrete aggregate is one of the most versatile and valuable building materials available to the construction industry.

**THE LARGEST SELLING PERLITE AGGREGATE IN THE WORLD**

### *better workability*

**PERMALITE** concrete aggregate offers better workability and unsurpassed ease of handling. A manufactured building product, it is always clean and uniform in quality. Packaged in 4 cu. ft. bags, weighing about 32 lbs., it is always easy to handle and easy to transport. It can be job-mixed, transit-mixed, pre-mixed, or pre-cast. Free-flowing, even in the coldest weather. PERMALITE concrete can be nailed, drilled, or sawed. Year-round uniform workability is the keynote of PERMALITE.



### *insulating*

**PERMALITE** concrete offers up to 20 times greater insulating value than ordinary concrete. PERMALITE adds high thermal insulation value to concrete, because its millions of microscopic sealed vacuum cells are permanent insulating agents that reduce heat transmission losses. Consequently, it is the ideal lightweight insulating concrete for roof decks, roof fill, floor slabs, and floor fill.



### *fire-resistant*

**PERMALITE** concrete offers 4 times greater fire-resistance value than ordinary concrete. It withstands temperatures up to 2300° F without melting. Mixed with cement to form concrete, PERMALITE adds inherent fire-proofing qualities to concrete.



### *low water-cement ratio*

**PERMALITE** concrete requires a lower water-cement ratio than other lightweight aggregates in the same weight class, which results in higher strengths at lower densities with less drying shrinkage.





# PERMALITE LIGHTWEIGHT INSULATING CONCRETE MIX DESIGNS

TABLE A  
PERMALITE LIGHTWEIGHT INSULATING CONCRETE • TYPICAL MIX DESIGN TABLE  
For PERMALITE Concrete Aggregate\*

TYPICAL PROPERTIES							MIX PROPORTIONS BY VOLUME			
Density (oven dry) Lbs. per cu. ft.	Compressive Strength PSI 28 days	Thermal Conductivity "K"***	Coefficient of Thermal Expansion per unit per °F	Tensile Strength PSI 28 days	Bond Strength to Steel PSI 28 days	Modulus of Elasticity in Compression PSI 28 days	Sacks of Cement	PERMALITE Cu. Ft.	Water per Sack Cement Gals.	Air Entraining Agent Pintst
35	450	.85	0.000060	69	83	245000	1	4	9	½
29	270	.67	0.000056	46	53	123000	1	5	11	⅝
26	190	.59	0.000048	32	23	114000	1	6	12	¾
23***	130	.53	0.000044	25	—	90000	1***	7	14	⅞
21	100	.50	0.000041	17	—	68000	1	8	16	1

PERMALITE lightweight insulating concrete physical properties are given in Table A. The densities and other values given here are a conservative composite of many tests conducted by recognized testing laboratories; tests of PERMALITE concrete mixed in their laboratories, and of samples taken from actual job installations. This data is presented only as a guide for PERMALITE lightweight insulating concrete design, and is not to be construed as a guarantee. Consult your local PERMALITE producer for best job practice in your area. Provide in your specifications that wet yield percentage be measured frequently during the pour, to insure proper density and insulating values.

\* Tests conducted with aggregate weighting 8 lbs./cu. ft.

\*\* "K" is B.T.U. per square foot per hour per degree Fahrenheit, 1" thick.

\*\*\* Data for 1-7 mix interpolated.

†Based upon ½ pint Neutralized Vinsol Resin per 4 cu. ft. bag of Permalite Concrete Aggregate.

## general description

PERMALITE concrete contains four ingredients, properly mixed, which are as follows:

1. Standard Portland cement Type I, Type II, or Type III, as prescribed in ASTM C150.
2. PERMALITE concrete aggregate.
3. Neutralized Vinsol Resin in liquid form of the type furnished by the manufacturers of PERMALITE.\*
4. Clean, clear water, free from alkalis, acids, organic matter, or other deleterious matter.\*\*

\* Tests were based on Vinsol Resin. However, other air-entraining agents have been used successfully. Consult your local PERMALITE distributor.

\*\* Hard water, especially water containing the calcium ion, will adversely affect the action of certain air-entraining agents. In such cases, it may be necessary to increase the quantity of the A.E.A.

## how to select the proper mix design

Two basic factors influence the choice of a proper mix design for the job on hand:

1. The insulation value of PERMALITE concrete is directly related to the density. The lower the density, the better the insulation value.
2. The strength of PERMALITE concrete also is directly related to the density. The higher the density, the greater the strength.

Since these two factors oppose each other, some sort of a compromise is indicated. The best approach is to determine, first, the minimum compressive strength needed, then select the strength requirement. Table A shows the mix-insulation relationships of several PERMALITE concrete mixes. The 1:6 mix ratio is recommended for most roof decks.

## specifications for PERMALITE concrete aggregate

PERMALITE Concrete Aggregate is expanded to conform to ASTM Specification C-332-54T for lightweight aggregate for insulating concrete. This specification states that the loose density shall not be less than 7½ lbs./cu. ft. or more than 12 lbs./cu. ft. when measured by the shoveling procedures ASTM C29-42.

SIEVE NO.	% PASSING BY WEIGHT	
	MINIMUM	MAXIMUM
4		100
8	85	100
16	40	85
30	20	60
50	5	25
100	0	10

TABLE B

## mix designs

The mix ratio of PERMALITE concrete is usually expressed as cubic feet of PERMALITE concrete aggregate per sack of cement. There are five standard mix ratios, as shown below in Table C.

TABLE C			
Mix Ratio Designation	Sacks of Cement*	PERMALITE Concrete Aggregate	
		Cubic Feet	Bags**
1:4	1	4	1
1:5	1	5	1¼
1:6	1	6	1½
1:7	1	7	1¾
1:8	1	8	2

\* One sack of Portland cement is one cubic foot.

\*\* PERMALITE is packaged in standard 4 cubic foot bags.

NOTE: 1:6 mix ratio is recommended for roof decks.



TABLE D

MATERIALS REQUIRED TO PRODUCE  
1 CU. YD. CONCRETE †

Sacks of Cement	PERMALITE* Cu. Ft.	Water Gals.	Air Entraining Agent* Pints
6.5	26	58½	6½
5.2	26	57	6½
4.33	26	52	6½
3.7	26	52	6½
3.25	26	52	6½

\*AEA is 14% neutralized Vinsol Resin solution.

**PERMALITE****LIGHTWEIGHT****INSULATING****CONCRETE**

**MIXING PROCEDURE** • While the means of mixing PERMALITE concrete is the same as it is for conventional sand-and-gravel concrete, the procedure for mixing differs considerably. It is very important that the mixing procedure outlined below be adhered to strictly:

1. Add to the mixer *all* of the necessary water.
2. With the mixer turning, add the required amount of liquid (never in powder form) neutralized Vinsol Resin.
3. With the mixer still turning, add the required amount of Portland cement and allow a slurry to form; continue mixing a few seconds.
4. Add the required amount of PERMALITE concrete aggregate.
5. Allow the batch to mix long enough to become plastic, then dump and place immediately. Always avoid excessive mixing and excessive handling.

**CONVEYING AND PLACING** • PERMALITE concrete can be conveyed from the mixer by any method that will not cause a segregation of materials. This includes all of the conventional methods and some types of pumps. When properly mixed, PERMALITE concrete has a farina-like consistency and is very easy to handle and place. In placing, it should not be rodded or tamped or handled excessively. The purpose of this minimum handling rule is to avert segregation of the materials and to prevent "knocking out" the air that has been entrained by the Vinsol Resin.

**DRYING TIME AND CURING** • PERMALITE concrete begins to set in about one hour after placing. It reaches its initial set in about four or five hours in normal drying weather. It takes from 36 to 48 hours to gain sufficient strength to withstand being walked upon without having its surface tracked. During this period, ranging from the initial set to the strength stage, curing should be employed to protect the concrete from hot sun or high winds. Covering or repeated fog spraying with water will bring about proper curing. Since the basic purpose of curing is to prevent too rapid drying, the amount of curing will depend upon weather conditions.

**RESTRICTIONS ON COLD WEATHER POURING** • All PERMALITE concrete materials and reinforcement forms, fillers, and earth with which PERMALITE concrete will come in contact should be free from frost. PERMALITE concrete should not be placed under 40° F or on frosted surfaces. In near-freezing weather, the water should be heated to a temperature of from 75° to 100° F. Adequate protection should be provided to enable the PERMALITE concrete to set properly during freezing or near-freezing weather.



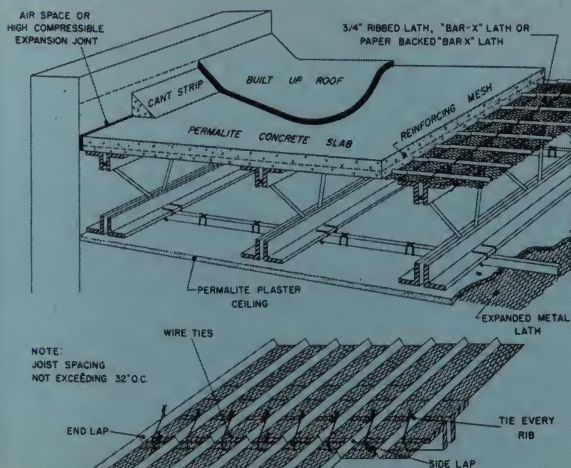
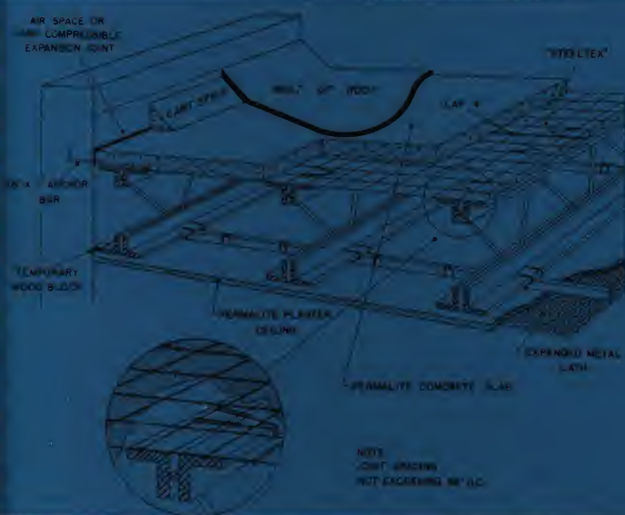
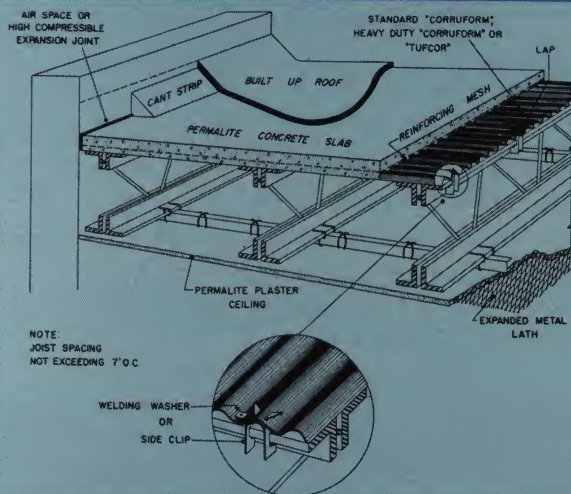
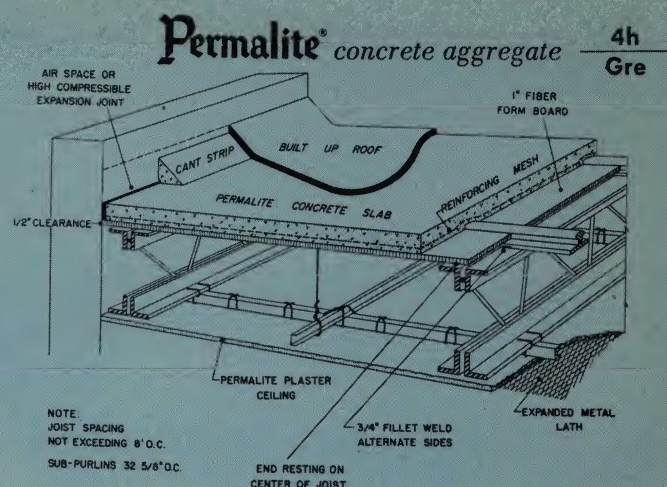
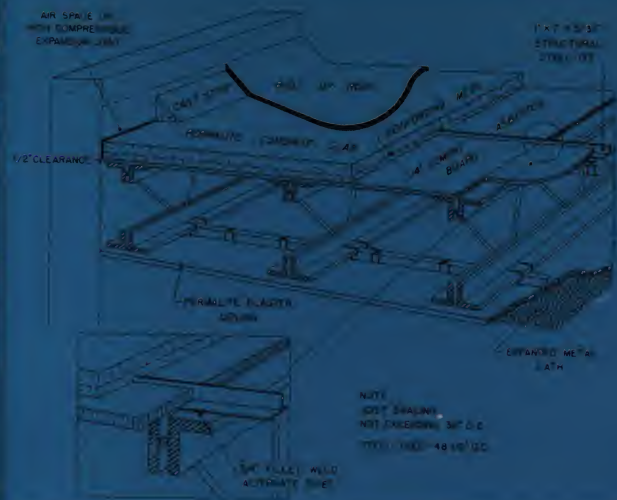
Permalite Plaster Aggregate, Permalite Concrete Aggregate, Permalite Acoustical Plaster, and Permalite Insulating Fill are among the building products available through Permalite franchisees. Write for additional information.



**FINISHING ROOF DECKS AND ROOF FILL** • The surface of the lightweight insulating concrete used for roof decks and roof fill should be carefully screeded; it should never be steel troweled. The slight texture formed on the surface as a result of careful screeding makes an exceptionally good monolithic base on which to apply the built-up roof. The texture provides a mechanical key for the mopped-on felt to augment the normal adhesion.

† Yield represented in Table D above can be achieved, and frequently is exceeded. When starting a pour, check yield at frequent intervals to be sure that the mix ratio, equipment, and mixing time are coordinated to produce the desired yield and density. If difficulty is experienced in obtaining yield, a check on the hardness of the water, and adjustment of quantity of air entraining admix, water content, and mixing time is indicated. In cases where insufficient yield has been figured on the basis of footage poured, the loss usually can be traced to irregular or sagging bases, or oversized screeds or forms.





The adaptability of lightweight insulating concrete made with PERMALITE concrete aggregate to various types of roof structures is shown in these illustrations.

### uses of the various mix designs

**1:6 MIX:** Concrete mixed in a ratio of 6 cubic feet of PERMALITE concrete aggregate to one sack of Portland cement is most commonly used in basic roof deck designs. It best meets average requirements of strength, weight, and insulation value.

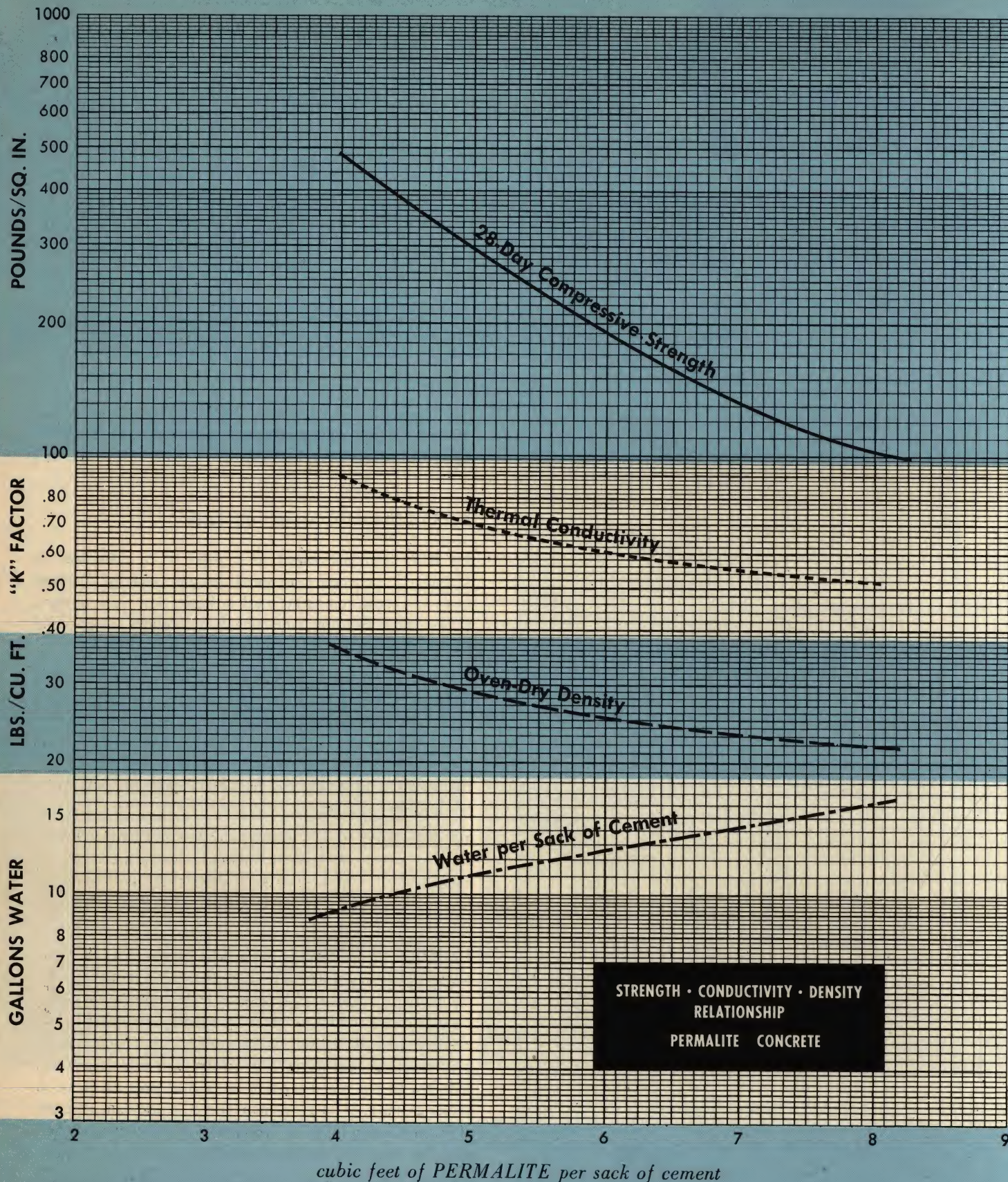
**1:4 MIX:** With higher strength requirements, a mix of 4 cubic feet of PERMALITE concrete aggregate to one sack of Portland cement is frequently used instead of the standard 1:6 mix. When used in place of the standard mix, the architect and engineer must consider the extra density of the cement and the need for increasing the thickness of the cement to maintain a given U value.

**1:5 MIX:** A mix design using 5 cubic feet of PERMALITE concrete aggregate to 1 sack of Portland cement is a compromise between the 1:4 and 1:6 mixes. It is not often used, except on some large areas, because it is more difficult to batch than the other two.

**1:7 MIX:** This mix should not be used for the slab over basic permanent form systems because it lacks sufficient strength for this purpose. However, because of its low density, this concrete possesses excellent insulating properties and more than average strength for use as an insulation and drainage fill over structural roof decks. The compressive and indentation strengths of this mix are equal to, and in most cases far in excess of, those of rigid insulation board. In addition, concrete of this mix design forms an economical and exceptionally firm monolithic base for the built-up roof.

**1:8 MIX:** This mix design, while having all of the limitations of the 1:7 mix, has a very low density and excellent insulation value. Its compressive and indentation strengths are equal to and exceed those of most of the rigid insulation boards. When used as an insulation and/or drainage fill over structural roof decks, it will provide an excellent monolithic base for the built-up roof. It is much more economical than most rigid board installations.





The curves in this chart are based on the values shown in the mix design table on page 3. All values vary with the density of the concrete; and the density varies with different mixing times and types of mixers. Therefore it is necessary when pouring insulating concrete to make frequent checks of wet yield in order to closely control the density. Slight deviations in quantities of water and/or air entraining agent may be necessary.



Estimating the quantities of materials to be used for PERMALITE lightweight insulating concrete is facilitated by the table given below. The factors are based upon units of one square (100 square feet) of slab area.

EXAMPLE: The following is an example of how the table can be used to estimate the quantities of materials that would be required to pour a 1:6 mix PERMALITE concrete slab, 3½ inches thick, on an area having 10,750 sq. ft.: First, determine the number of squares in the area by dividing the total area by 100. The number of squares will then be used as a common factor. Second, locate in the first column, headed "Slab Inches Thick", the thickness of, or average thickness of, the slab to be poured, in this case, 3.50". To determine the quantities of various materials needed, multiply the number of squares by the factors that appear under each respective column opposite the slab thickness of 3.50".

A. Number of Squares:  $\frac{10,750}{100} = 107.5$  squares

B. Cubic Yards of PERMALITE Concrete Required:  
 $107.5 \times 1.078 = 115.88$  cubic yards

C. Bags of PERMALITE Concrete Aggregate Required:  
 $107.5 \times 7.0 = 752.5$  bags of PERMALITE

D. Sacks of Cement Required for 1:6 Mix:  
 $107.5 \times 4.66 = 500.95$  sacks of cement

E. Air Entraining Agent:

As shown in Table A under "Mix Proportions by Volume", NVX (neutralized vinsol resin solution) is generally calculated on the basis of ½ pint per 4 cu. ft. bag of PERMALITE concrete aggregate. Therefore, the required amount of A.E.A. is 376.25 pints.

It should be noted, however, that hard water (especially water containing calcium ion) adversely affects the air-entraining qualities of vinsol resin solutions. It is obvious, then, that when such water is used, the A.E.A. admix must be increased to compensate. It is necessary, when mixing PERMALITE lightweight insulating concrete, to make frequent yield tests in order to achieve the desired densities and insulation values.

### ESTIMATING MATERIALS

**IMPORTANT:** In all construction using PERMALITE concrete, it is necessary to provide compressible expansion joints of ½" minimum thickness for each 100 lineal feet of slab.

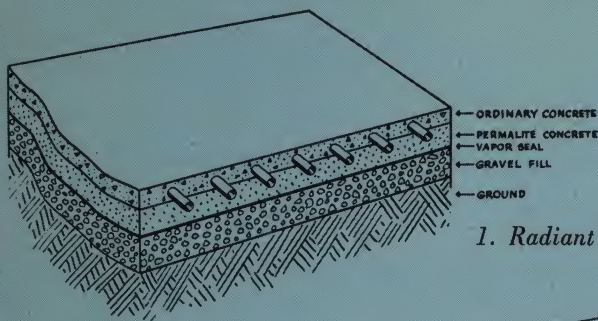
*PERMALITE concrete: bags of PERMALITE and sacks of cement*

TABLE F

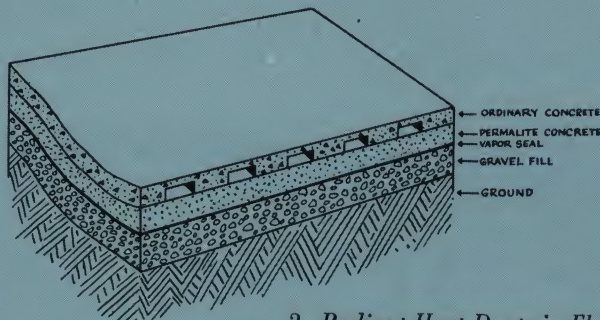
SLAB INCHES THICK	CU. YDS. PER 100 SQ. FT.	BAGS OF PERMALITE 100 SQ. FT.	SACKS OF CEMENT REQUIRED PER 100 SQ. FT. MIX RATIO				
			1:4 MIX	1:5 MIX	1:6 MIX	1:7 MIX	1:8 MIX
2.00"	.616	4.00	4.00	3.20	2.666	2.300	2.00
2.25"	.693	4.50	4.50	3.60	3.000	2.585	2.25
2.50"	.770	5.00	5.00	4.00	3.333	2.870	2.50
2.75"	.847	5.50	5.50	4.40	3.666	3.155	2.75
3.00"	.924	6.00	6.00	4.80	4.000	3.450	3.00
3.25"	1.001	6.50	6.50	5.20	4.333	3.735	3.25
3.50"	1.078	7.00	7.00	5.60	4.666	4.020	3.50
3.75"	1.155	7.50	7.50	6.00	5.000	4.305	3.75
4.00"	1.232	8.00	8.00	6.40	5.333	4.600	4.00
4.25"	1.309	8.50	8.50	6.80	5.666	4.885	4.25
4.50"	1.386	9.00	9.00	7.20	6.000	5.170	4.50
4.75"	1.463	9.50	9.50	7.60	6.333	5.455	4.75
5.00"	1.540	10.00	10.00	8.00	6.666	5.750	5.00
5.25"	1.617	10.50	10.50	8.40	7.000	6.035	5.25
5.50"	1.694	11.00	11.00	8.80	7.333	6.320	5.50
5.75"	1.771	11.50	11.50	9.20	7.666	6.605	5.75
6.00"	1.848	12.00	12.00	9.60	8.000	6.838	6.00



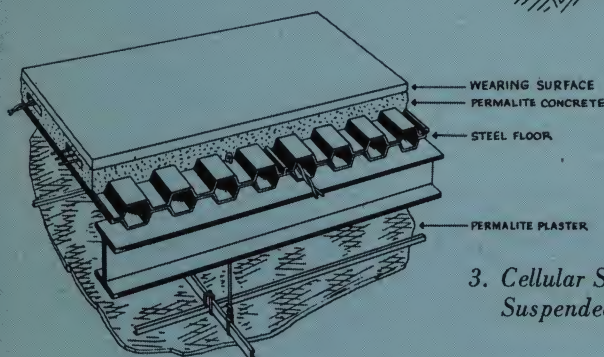
# TYPICAL FLOOR CONSTRUCTION WITH **Permalite**® LIGHTWEIGHT INSULATING CONCRETE



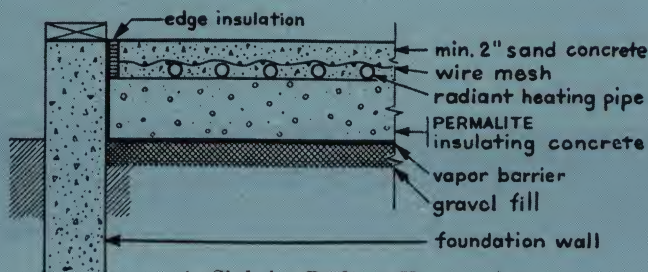
1. Radiant Heat Pipes in Floor



2. Radiant Heat Ducts in Floor



3. Cellular Steel Floor  
Suspended Plaster Ceiling



4. Slab for Radiant Heating Systems

**GRADE LEVEL FLOORS AND RADIANT HEATING** — Used in floor slabs in basementless homes, PERMALITE lightweight insulating concrete minimizes costly heat loss into the ground, prevents moisture condensation on the floor surface during hot and humid weather, and increases year-round comfort.

The operating economy of slab-type radiant heating systems can be improved greatly by placing a slab of PERMALITE lightweight insulating concrete under radiant heating pipes before they are embedded in heavy-density concrete. Heat loss from hot air perimeter heating systems also can be minimized by embedding the hot air pipes in a PERMALITE concrete sub-floor slab.

For all grade level slabs, a well-drained base covered with a tamped fill of coarse stone or gravel is desirable. A moisture barrier such as one or more layers of saturated 15-lb. felt with lapped and sealed joints should be applied under the insulation, directly over the leveled fill.

A 1:6 or 1:4 mix can be used for the PERMALITE lightweight insulating concrete if it is topped with at least 2 inches of ordinary concrete reinforced with welded wire mesh.

PERMALITE concrete aggregate is a building product produced by licensed franchisees from perlite ore mined by:

## GREAT LAKES CARBON CORPORATION • PERLITE DIVISION

612 south flower street • los angeles 17, california • telephone: madison 9-1611

### COLORADO

Persolite Products, Inc., 1245 Osage Street,  
Denver 3, Colorado — Telephone: AComa 2-6111

### FLORIDA

Airlite Processing Corporation of Florida,  
Building No. 9, Air Base, Vero Beach, Florida —  
Telephone: 3518

### GEORGIA

Southern Insulation Company  
P. O. Box 2082, Atlanta 1, Georgia

### ILLINOIS

Ryolux Corporation, 310 East Bradley Street,  
Champaign, Illinois — Telephone: 6-4234

Silbrico Corporation, 5901 West 66th Street,  
Chicago 38, Illinois —  
Telephone: REliance 5-3322

### INDIANA

Airlite Processing Corporation, Scottsburg,  
Indiana (Office), Vienna, Indiana (Plant) —  
Telephone: PLaza 1-5538 and PLaza 1-8821

### MASSACHUSETTS

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Roslindale 31 (Boston), Massachusetts —  
Telephone: FAirview 3-6020

### MICHIGAN

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Telephone: GLendale 4-5322

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### NORTH CAROLINA

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Telephone: 3986

### OHIO

Indoken Perlite Company, 5300 Vine Street,  
Cincinnati 17, Ohio — Telephone: Avon 9946

### PENNSYLVANIA

Pennsylvania Perlite Corporation,  
P. O. Box 694, Allentown, Pennsylvania —  
Telephone: COngress 4-2891

Perlite Manufacturing Company, P. O. Box 478 —  
Arch Street Extension, Carnegie, Pennsylvania —  
Telephone: WALnut 1-9200 (Pittsburgh)

### TEXAS

Perlite of Houston, Inc., 3010 Dixie Drive (Office),  
502 Fauna Avenue (Plant), Houston, Texas —  
Telephone: JACKson 8-2243

Texas Lightweight Products Company,  
117 North Britain Road, Irving, Texas —  
Telephone: 2-8181 (Irving), RANDolph 5354 (Dallas)

### VIRGINIA

Virginia Perlite Corporation, P. O. Box 687,  
Hopewell, Virginia —  
Telephone: CEdar 9-4172 and CEdar 9-2676

### WISCONSIN

Badger Lightweight Products Corporation,  
3101 West Mill Road, Milwaukee 9, Wisconsin  
Telephone: FLagstone 1-9050

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Perlite Products, Ltd., 500 Raleigh Street,  
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Perlite Industries, Reg'd., 500 Canal Bank,  
Ville St. Pierre, Quebec, Canada —  
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